Inventors: Wood et al.
Serial No. 09/813858

PATENT APPLICATION
Navy Case No. 79,849

IN THE CLAIMS

Please cancel claims 1-53.

Please insert the following new claims 54 – 101.

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Rule 1.126

54. A detector for detecting a photon, comprising:

a substrate,

a photon absorber disposed upon said substrate,

a thermoelectric sensor, disposed upon said substrate and thermally coupled with said photon absorber, and

a heat sink disposed upon said substrate, thermally coupled to the thermoelectric sensor,

for absorbing a photon and generating a voltage differential across said sensor between said absorber and said heat sink in response to said photon absorption.

55. The detector of claim 54, further comprising means to measure said voltage differential.

56. The detector of claim 54, wherein said substrate comprises a dielectric material.

57. The detector of claim 54, wherein responsive to arrival of a photon,

said absorber is heated,

so that heat in said absorber is transferred to said sensor and further transferred to said heat sink.

58. The detector of claim 54, wherein said heat is transferred from said absorber to said heat sink faster than heat is transferred from said absorber to said substrate.

A1 Cont'd

59. The detector of claim 58, wherein the time for said heat to be transferred from said absorber to said heat sink is about ten times less than the time for heat to be transferred from said absorber to said substrate.

60. The detector of claim 55, further comprising superconducting leads for measuring said voltage differential.

61. The detector of claim 60, further comprising an input coil of a flux transformer electrically connected to said superconducting leads.

62. The detector of claim 60, further comprising an input coil of a flux transformer of a superconducting quantum interference device circuit electrically connected to said superconducting leads.

63. The detector of claim 54, wherein the absorber and the heat sink have the same heat capacity.

64. The detector of claim 63, wherein the absorber and the heat sink are alike in material and geometry.

a1 Cont'd

65. The detector of claim 54, wherein said thermoelectric sensor comprises a thin film disposed upon said substrate.

66. The detector of claim 54, wherein said thermoelectric sensor comprises a material with isotropic thermoelectric properties.

67. The detector of claim 65, wherein said thin film comprises gold with impurities.

68. The detector of claim 65, wherein said thin film comprises gold with iron impurities between about 10 ppm and 100 ppm.

69. The detector of claim 65, wherein said thin film comprises a metal with a Seebeck coefficient of at least about 10 μV/K at an operating temperature of said detector.

70. The detector of claim 65, wherein said thin film comprises a metal with a Seebeck coefficient of between about 10 μV/K and about 80 μV/K at an operating temperature of said detector.

71. The detector of claim 65, wherein said thin film comprises lanthanum cerium hexaboride.

al Cont'd

72. The detector of claim 54, wherein said photon absorber is selected from the group comprising Be, As, Sb, Bi, Au, Ag, and W.

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~~73~~. The detector of claim 72, wherein said photon absorber comprises bismuth.

73. The detector of claim 54, wherein said heat sink is selected from the group comprising Be, As, Sb, Bi, Au, Ag, and W.

74. The detector of claim 73, wherein said heat sink comprises bismuth.

75. The detector of claim 54, further comprising a superconducting element electrically coupled to the heat sink and the photon absorber.

76. The detector of claim 54, further comprising said sensor connected between said absorber and said heat sink.

77. The detector of claim 54, further comprising niobium electric leads attached to said heat sink and to said absorber for measuring said voltage differential.

a\ cont'd

78. The detector of claim 54, wherein said sensor has a resistance R which is less than r_0L_0/T^2A_{abs}, where r_0 is the Kapitza resistance constant between the absorber and the substrate, L_0 is the Lorenz number, T is the operating temperature of the detector, and A_{abs}, is the cross se ctional area of the absorber.

79. The detector of claim 78, wherein said r_0 is about 20 K^4cm^2/W and said L_0 is about 25 nW-Ω/K^2.

80. A photon detector comprising:

a thin dielectric wafer having a photon absorber disposed on the edge of said wafer,

a thermoelectric sensor disposed on said wafer, and

a heat sink disposed on said wafer,

wherein said thermoelectric sensor is thermally coupled with said photon absorber, said heat sink is thermally coupled to said thermoelectric sensor,

for absorbing a photon and generating a potential across said sensor, whereby there is a voltage differential between said absorber and said heat sink in response to said photon absorption.

81. The photon detector of claim 80, wherein

said heat sink and said thermoelectric sensor are disposed on the edge of said wafer

a1 Cont'd

82. The photon detector of claim 81, further comprising a voltage differential measuring means disposed upon a face of said wafer.

83. The photon detector of claim 82, wherein said voltage differential measuring means comprises a SQUID array amplifier.

84. The photon detector of claim 83, wherein said voltage differential measuring means comprises semiconductor electronics.

85. A photon detector comprising:

a substrate, and

a thermoelectric sensor comprising a thin anisotropic superconducting film, disposed upon the substrate,

for receiving photons and for generating a voltage differential across the sensor in a longitudinal direction which is perpendicular to the plane of the sensor.

86. The photon detector of claim 85, wherein the Seebeck coefficient of the sensor in one direction is larger than in other directions.

a\ cont'd

87. The photon detector of claim 86 wherein said substrate comprises a dielectric material.

88. The photon detector of claim 87, wherein the substrate is a viscinally cut dielectric material having a tilt angle less than about 45 degrees between the sensor's a-b plane and longitudinal axis.

89. The photon detector of claim 85, wherein said thin anisotropic superconducting film has an effective length L in the longitudinal direction much greater than its thickness.

90. The photon detector of claim 85, wherein said thin anisotropic superconducting film comprises a oxide-layered superconducting film in normal state.

91. The photon detector of claim 90, wherein said oxide-layered superconducting film is selected from the group comprising YBaCuO, LaCuO, and LaBaCuO.

92. The photon detector of claim 90, wherein said oxide-layered superconducting film comprises $La_2CuO_{4+\delta}$.

93. The photon detector of claim 90, wherein said oxide-layered superconducting film comprises $La_{2-x}Ba_xCuO_4$.

a1 Cont'd

94. The photon detector of claim 90, wherein said oxide layered superconducting film comprises $YBa_2Cu_3O_7$.

95. The photon detector of claim 85, further comprising:

an insulating layer disposed upon said sensor and

a normal-metal absorber disposed upon said insulating layer, said absorber for absorbing incident photons, and said insulating layer for preventing electrical shorts between portions of said sensor.

96. The photon detector of claim 95, wherein said normal-metal absorber is tungsten.

97. The photon detector of claim 85, further comprising a non-electrically conducting absorber disposed upon said insulating layer, said absorber for absorbing photons.

98. A photon detector comprising:

a viscinally cut dielectric substrate having a tilt angle of about 5 degrees,

a thermoelectric sensor comprising a thin oxide superconductor anisotropic film in normal state disposed upon said substrate,

for receiving photons and for generating a voltage differential across the sensor in a longitudinal direction.

al cancl'd

99. A photon detector comprising:

a viscinally cut dielectric substrate having a tilt angle of less than about 5 degrees,

a thermoelectric sensor comprising a thin superconducting anisotropic oxide film disposed upon said substrate,

an insulating barrier disposed upon said thin superconducting anisotropic oxide film,

and an absorber for receiving photons,

for receiving photons and for generating a voltage differential across the sensor in a longitudinal direction.

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100. . A photon detector as in claim 65, wherein said thin film comprises CeNiSn.

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101. A method for detecting a photon, comprising the steps for:

receiving a photon at an absorber disposed on a substrate,

generating a voltage differential in reponse to said photon received on said substrate,

measuring said voltage differential.